WE CLAIM

1 A method of designing geophysical surveys, comprising:

i) defining a target of interest;

ii) defining a receiver location region in a predetermined position relative to the target;

iii) defining positions within the receiver location region for a predetermined number of receivers;

iv) preparing a geophysical model which includes the target, the receiver location region and a source location region;

v) using the model to propagate ray traces from the receiver positions to the source location region via the target;

vi) sub-dividing the source location region according to ray trace density resulting from the propagation; and

vii) designating one or more potential source positions according to the ray trace density in a respective sub-division.

2 A method as claimed in claim 1, wherein the geophysical survey comprises a borehole seismic survey.

3 A method as claimed in claim 2, wherein the target comprises a region of a surface of a formation surrounding the borehole.

4 A method as claimed in claim 2, wherein the receiver location region comprises a portion of the borehole in which one or more receivers can be positioned.

5 A method as claimed in claim 1, wherein the geophysical model includes identification of layers of underground formations and material properties of these layers.

6 A method as claimed in claim 1, further comprising constructing a ray trace density histogram in the source location and using this histogram to define the source locations.

7 A method as claimed in claim 1, wherein the step of preparing a geophysical model comprises the steps of:

a) defining a volume of interest;

b) defining surfaces within the volume of interest to delimit layers of the model; and

c) assigning material properties to the layers of the model.

8 A method as claimed in claim 7 wherein the surfaces are defined in terms of two dimensional arrays of data representing surface position at that point in a third dimension.

9 A method as claimed in claim 7, wherein the material properties include Vp/Vs ratio, compressional velocity, and density.

10 A method as claimed in claim 7 further comprising defining a borehole location within the volume of interest.

11 A method as claimed in claim 7, wherein one of the surfaces contains the target and including the step of defining a portion of the surface containing the target.

12 A method as claimed in claim 1, wherein the step of propagating ray traces from the receiver locations to the source locations comprises defining at least on ray tracing cone for each receiver location, and adjusting the direction and inclination of the cone to intersect the target

13 A method as claimed in claim 1, further comprising validating designated potential source locations by propagating ray traces from the potential source locations back to the receiver locations via the target, and identifying on the target reflection points for the ray traces.